OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

Semester 2 Examinations 2022-2023

Course Instance Code(s)	4BCT1, 4BS2
Exam(s)	Fourth B.Sc. Computer Science and IT Fourth B.Sc Science
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Paper No.	1
External Examiner(s)	Dr. R. Trestian
Internal Examiner(s)	Professor M. Madden *Dr. C. O'Riordan

Instructions: Answer any 3 questions. All questions are equally weighted.

Duration	2 hours
No. of Pages	3
Discipline(s)	Computer Science
Course Co-ordinator(s)	Dr. C. O'Riordan

Requirements:

Release in Exam Venue	Yes
Handout	None
Statistical/ Log Tables	None
Cambridge Tables	None
Graph Paper	None
Log Graph Paper	None
Other Materials	None

PTO

CT421 Artificial Intelligence

Q.1.

(a) With respect to a suitable game of your choice, show how the *minimax algorithm* can be applied to choose suitable moves to play the game. Your answer should include an explanation as to how to build the game tree and assign values. Discuss the efficiency of the approach and how it could be improved. (10)

(b) The minimax algorithm is often applied in two player games when one can list all game states. Discuss, briefly, how you might augment the minimax approach to deal with scenarios where one cannot enumerate all potential game states. (8)

(c) Explain, with respect to any domain of your choice, the concept of novelty search in Artificial Intelligence. (7)

Q.2.

(a) With reference to Genetic Algorithms and the schema theorem, explain the effects on a population of solutions of:

a) Mutation
b) Crossover
c) Selection

(11)

(b) A university wishes to allocate projects to students. There exist a set of projects and a set of students. No two students can take the same project. Each student ranks their top 10 projects in order. It is decided to use a genetic algorithm to find a solution to the allocation problem.

Explain how you would apply a genetic algorithm to find a solution. Your answer should include a description of suitable fitness function, a suitable representation of the chromosomes, and a description of the operators. (14)

Q.3.

(a) Auction protocols have been adopted in the multi-agent system community as a means to allow agents find an agreement suitable to all parties. Compare the English auction protocol with the Dutch auction protocol. Your answer should include:

i) A description of the protocol involved
ii) An explanation of the rational strategy for the bidders
iii) Any potential limitations of the protocol.

(9)

(b) Auctions have been used to allow agents to agree on a price. Suggest an efficient approach that would allow agents to negotiate with the aim of finding points of agreement on a number of attributes in addition to price. (8)

(c) Game theory has been used in a number of domains to model and reason about strategic decision making. With respect to game theory, explain the following concepts: a dominant strategy, Nash equilibrium. (8)

Q.4.

(a) Explain briefly the importance of *explainability* in artificial intelligence. With reference to an AI paradigm of your choice, outline approaches that have been taken towards building AI systems that can generate explanations. (8)

(b) Describe, in your own words, what is meant by neuro-evolution. Describe a suitable means to represent a neural network for a neuro-evolution system. (9)

(c) With reference to any existing systems, explain what you would consider to be the main properties of an artificial life system. (8)

End